

Ultra Long Duration Balloon (ULDB)

Overview



14 meter Scaled Model Test #1 - August 2004



ULDB Development Approach

- In response to the 2003 Flight 517-NT Anomaly Review Board (ARB), the BPO initiated a comprehensive reevaluation of the ULDB development.
- The ULDB project in 2004 incorporated a stepwise development approach emphasizing improved validation of design and performance models.
 1. Manufacturing improvements
 2. Scale model development to facilitate improved design understanding.
 3. Analysis and testing of critical ULDB material issues
 4. Development of ULDB vehicle through incremental balloon test flights

6.2 MCF	3000 lbs(suspended)	100 K FT
12 MCF	3000 lbs(suspended)	110 K FT
22 MCF	6000 lbs(suspended)	110 K FT
 5. Development of electronics and sensor upgrades
 6. Assess operation improvements.



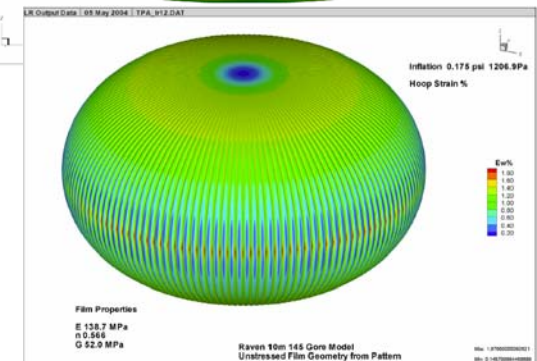
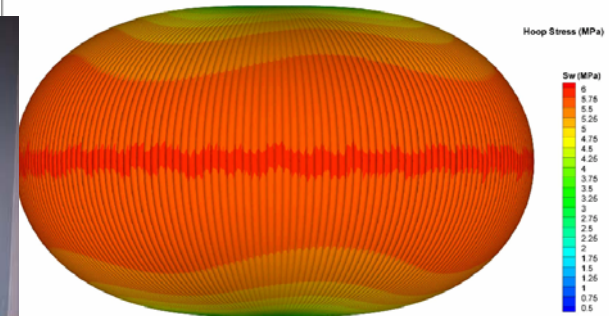
ULDB Status

- ULDB Project Team has successfully implemented the recommendations of the 2003 Flight 517-NT ARB.

✓ Develop analytical basis for the design of the balloon.

✓ Develop a test validated analytical model of the ULDB that is peer reviewed and accepted as a trustworthy tool in developing balloon designs.

✓ Conduct a series of tests on small balloons to investigate the undesirable equilibrium shape problem with emphasis on determining the sensitivity to excess gore width could serve as the basis for the analytical modeling effort.

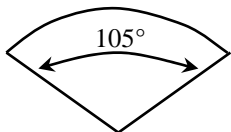




ULDB 14 meter Model Test #2 - October 2004



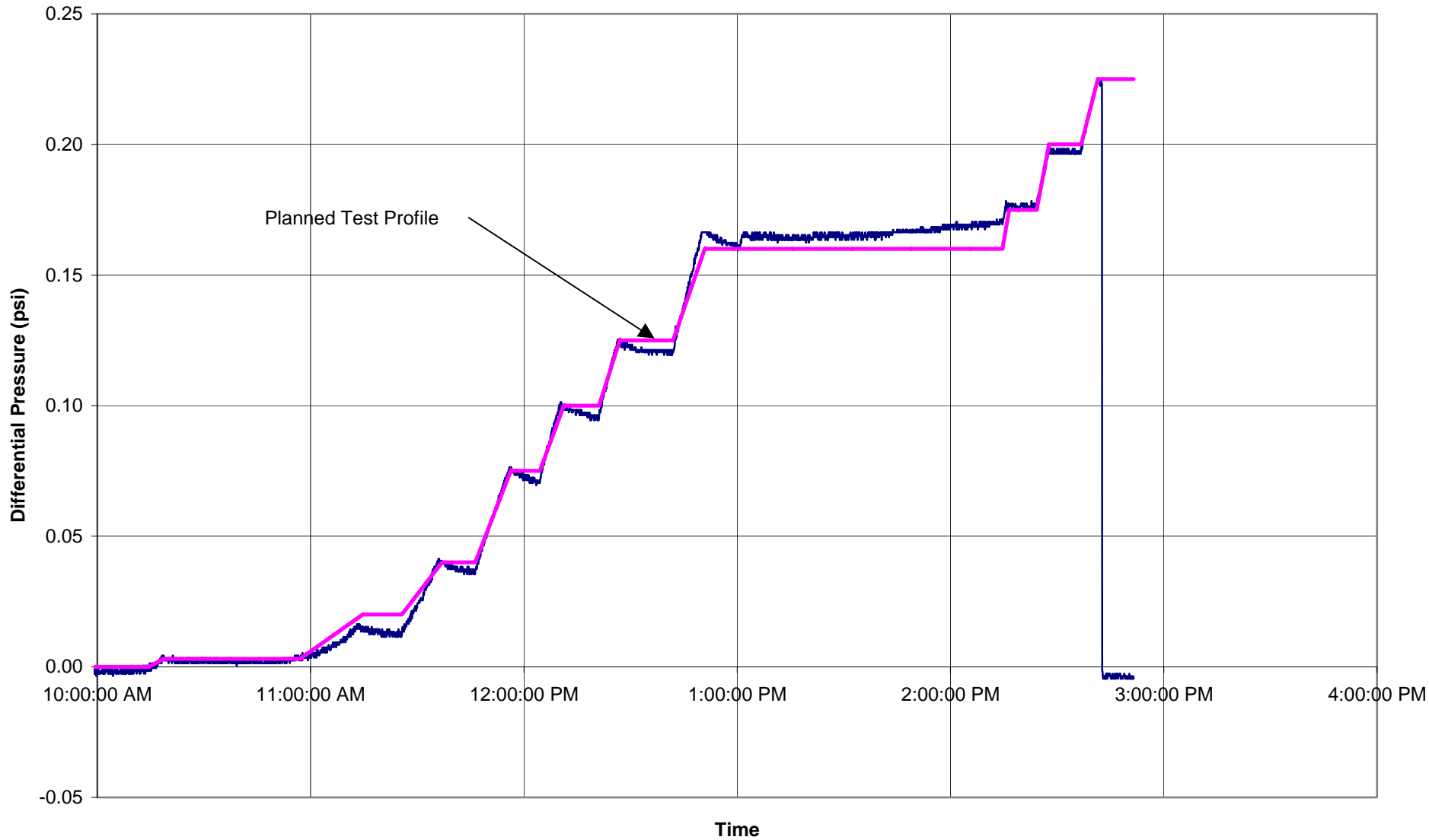
14.3 m diameter
200 gores
 $R/c_{max}=0.63$



- Second test of 200 gore fourteen meter model balloon conducted October 15, 2004
- Full deployment under almost no pressure (<0.01 psi)
- Balloon deployed fully and was stable during all pressure steps and during the one hour pressure hold
- Structure deformed after pressure reached 0.225 psi level



ULDB 14 meter Model Test #2 Profile - October 2004





ULDB Model Predictions and Results - October 2004

- Pre-test analytical predictions completed using balloon design pattern and refined material properties
- TENSYS analysis predictions and the test results:

Prediction	Test Result	
Will deploy at low differential pressure	Balloon deployed at low differential pressure	✓
Predicted stable at maximum design pressure	Balloon was stable at maximum design pressure	✓
Stress distributions at maximum equivalent differential pressure	Stress distributions were the same or less at maximum equivalent differential pressure	✓
Model predicted to be on the edge of stability at 0.2 psi	Model was stable at 0.2 psi	✓
Analysis predicts that model is expected to be able to be forced under pressurization into a deformed shape before destruction	Balloon was forced under pressurization (0.225 psi) to start changing into a deformed shape and then ruptured. Stability/Instability line confirmed.	✓

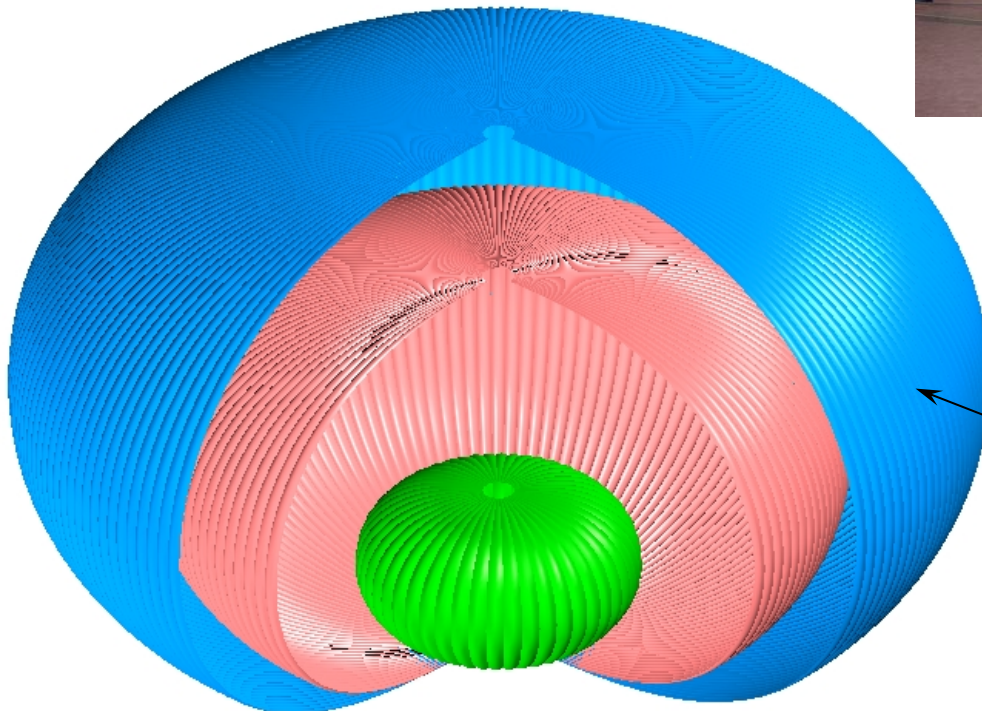


Summary of Test Articles to Date

- Test articles have been of three different sizes
 - 4 m diameter, 48 gores
 - 10 m diameter, 145 gores
 - 14.3 m diameter, 200 gores



~6 ft Tall Person

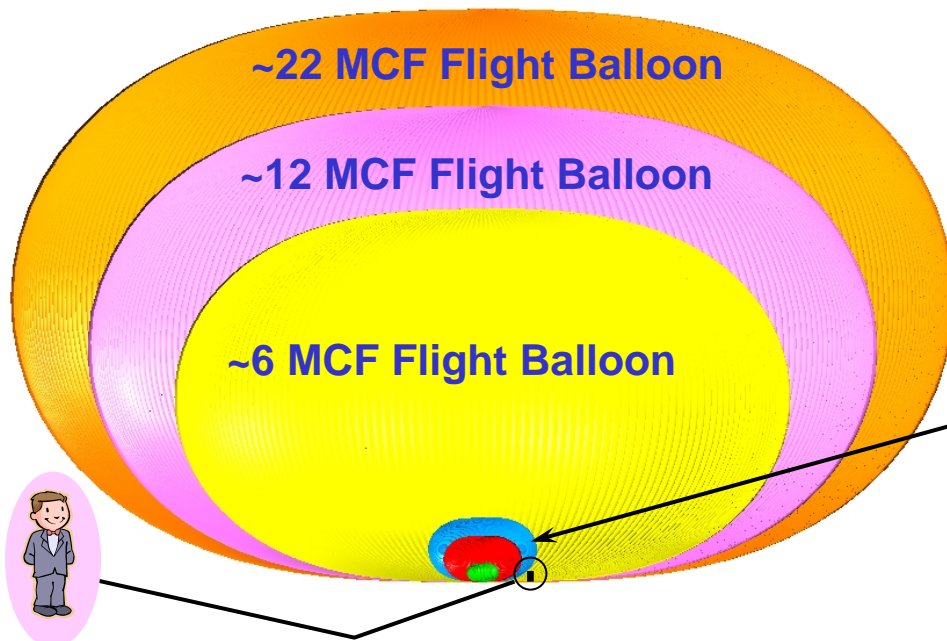


14.3 m Diameter
200 Gore Balloon



Test Articles Versus Flight Balloons

- ULDB Scaled Model Test Articles compared to the ULDB Flight Balloons.



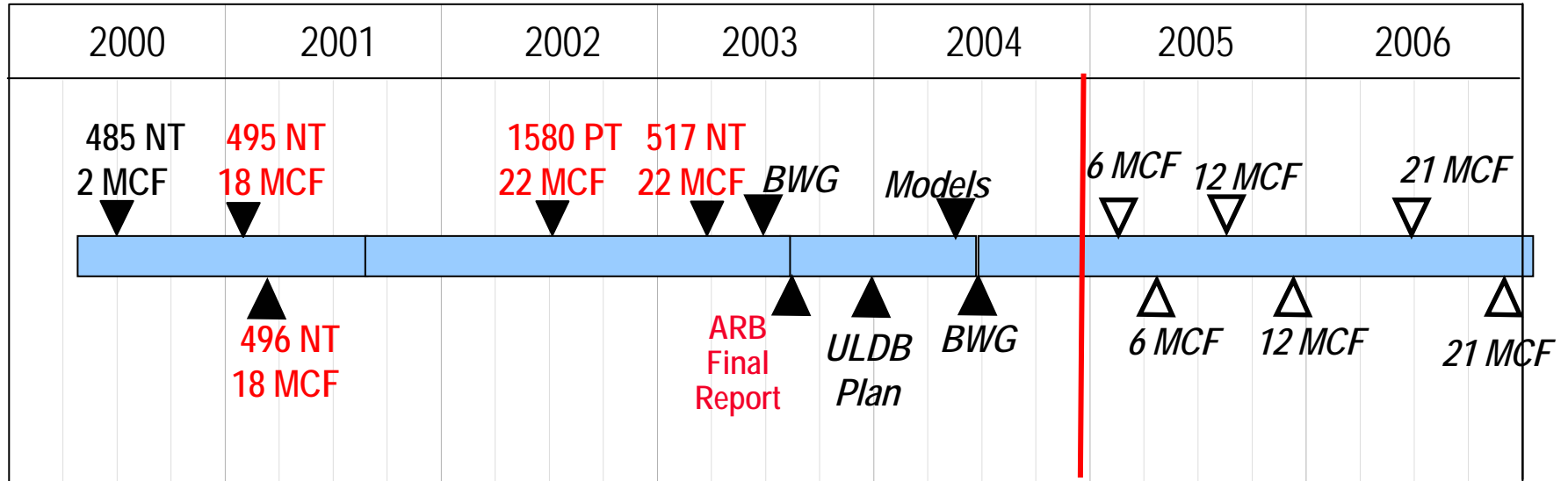
~ 6 ft Tall Person

14.3 m Diameter
200 Gore Test
Balloon



ULDB PROJECT TIMELINE

Calendar Years



Status as of 1/21/05

- 6.2 MCF Balloon Fabricated
- Launch Preparations Underway in Ft. Sumner, New Mexico
- Flight Ready Target Date: January 26, 2005